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SURVEY BULLETIN

Forest Insect and Disease Conditions in Ontario

Fall 1987

Egg-laying Female Gypsy Moth

GREAT LAKES FORESTRY CENTRE
Box 490 • Sault Ste. Marie Ontario

88-04110/

FOREST INSECT AND DISEASE CONDITIONS IN ONTARIO

Fall 1987

This is the last of three Survey Bulletins describing forest insect and disease conditions in Ontario in 1987.

ANNUAL FOREST PEST REVIEWS

The 11th annual Ontario forest pest reviews were held in late October and early November this year. The northern review was held on 28 October at the Great Lakes Forestry Centre (GLFC) in Sault Ste. Marie and the southern review on 3 November at the Holiday Inn Downtown in Toronto. Topics addressed at the northern review included the spruce and jack pine budworm situations, pinewood nematode, a western gall rust survey, pests of white spruce plantations, pests of seeds and cones, the impact of spruce budworm on wood supply in the Dog River-Mattawan Forest Management Agreement (FMA), a spruce budworm strategy for Ontario, and the herbicide program in Ontario. In addition an update on nursery pests in northern Ontario and brief outlines of other current forest insect and disease problems were presented. A videotape on the Forest Pest Management Institute (FPMI) completed the program.

The southern review featured presentations on the gypsy moth, Scleroderris canker (European race), the pinewood nematode, sugar maple in Ontario, and pests of white spruce plantations and of seeds and cones. Updates of nursery pests of southern Ontario and other current forest pest problems were also included. The FPMI video-tape was also shown at the southern pest review. Mr. J.H. Cayford, the retiring Director General of GLFC, addressed both meetings. Mr. Cayford's remarks are appended to this Bulletin.

Presentations were made by staff of the Ontario Ministry of Natural Resources (OMNR), the Canadian Forestry Service (CFS) (including GLFC, FPMI and the Laurentian Forestry Centre) and Agriculture Canada. The northern review was attended by 70 people and the southern review by 117.

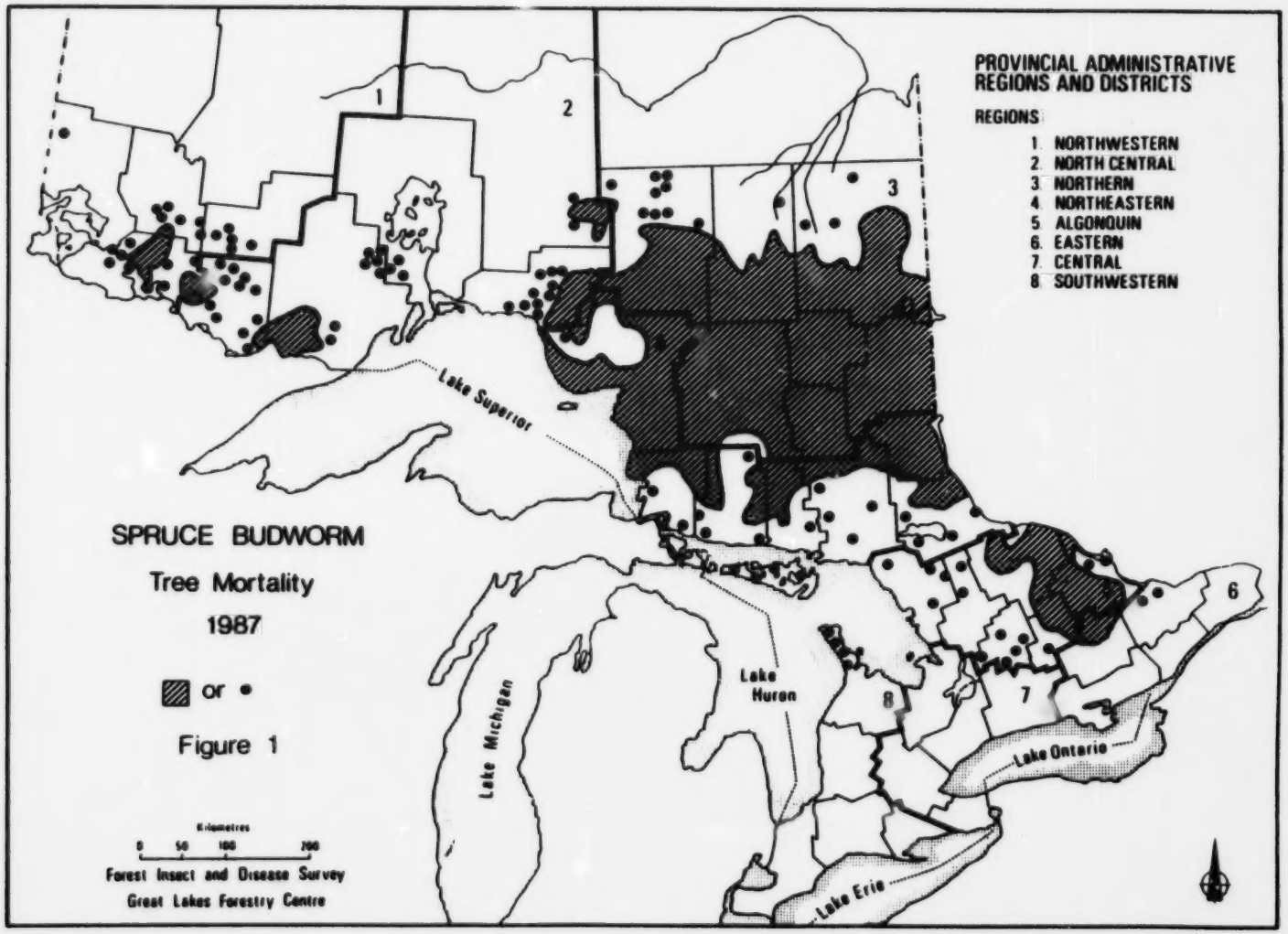
Spruce Budworm, *Choristoneura fumiferana* (Clem.)

The spruce budworm infestation in Ontario decreased in both area and intensity in 1987. All together, 7,189,763 ha of moderate-to-severe defoliation were mapped, a reduction of 1,665,924 ha (19%) from the 8,855,687 ha recorded in 1986.

Most of the reduction occurred along the eastern edge of the infestation in the Wawa, Hearst and Terrace Bay districts, although substantial reductions also occurred in the Geraldton and Thunder Bay districts. An increase of about 50,000 ha occurred mainly along the northern edge of the infestation in the Red Lake, Sioux Lookout and Ignace districts. The remaining infestation was split up into two very large sections and a number of smaller pockets occupying large areas of the Northwestern and North Central regions, from the Manitoba border eastward to the southwestern Geraldton and western Terrace Bay districts. Throughout much of this area, defoliation, though still classified as moderate-to-severe, was much reduced over 1986 levels. One of the factors that may have been responsible for this was heavy spring frosts, which occurred in northwestern Ontario from 22 to 25 May. The remainder of northern Ontario, consisting of the Northern and Northeastern regions, was completely free of spruce budworm for the first time in many years. The same is true of southern Ontario, with the exception of three small pockets of defoliation in the Bracebridge District.

Surveys for tree mortality caused by spruce budworm were carried out during the latter part of the field season and consisted of aerial observations supported by ground checks in a number of locations. These revealed a total area of 14,067,082 ha of mortality, an overall increase of 82,174 ha over the 1986 figure of 13,985,708 ha. A large part of this new mortality occurred along the eastern edge of the large area of budworm mortality located in the southwest corner of the Thunder Bay District. Most of the remainder consisted of small scattered pockets in the Ignace and Atikokan districts, the southern Dryden District and the eastern Fort Frances District. A few small, scattered pockets were also evident west of Black Sturgeon Lake in the adjoining Nipigon and Thunder Bay districts as well as in the southern Terrace Bay District and the southeastern corner of the Geraldton District (Fig. 1).

The annual spruce budworm egg survey was carried out in the latter part of the field season with 463 locations sampled across the province. An analysis of the results, based on a comparison of some 346 locations sampled in both 1986 and 1987 (Tables 1, 2 and 3), shows an overall decrease of 47% in egg-mass densities. The reduction was consistent in all districts in which sampling took place, with the exception of Ignace and Red Lake districts, in which egg-mass densities increased. Despite the downward trend, egg-mass densities remain sufficiently high that moderate-to-severe defoliation will probably persist in most of the areas now infested in the Northwestern Region and, indeed, some expansion is possible in the area south of Trout Lake in


PROVINCIAL ADMINISTRATIVE REGIONS AND DISTRICTS
REGIONS
1. NORTHWESTERN
2. NORTH CENTRAL
3. NORTHERN
4. NORTHEASTERN
5. ALGONQUIN
6. EASTERN
7. CENTRAL
8. SOUTHWESTERN
Lake Superior
Lake Michigan
Lake Huron
Lake Ontario
Lake Erie
SPRUCE BUDWORM
Tree Mortality
1987
or
Figure 1
Kilometres
0 50 100 200
Forest Insect and Disease Survey
Great Lakes Forestry Centre

the Red Lake District. In the North Central Region, in which overall egg densities are down by about 55%, defoliation will probably decrease to light intensity, with occasional moderate pockets east of Lake Nipigon in the Geraldton, Terrace Bay and eastern Nipigon districts. In the western Nipigon District, moderate-to-severe defoliation will probably persist in the area between Lake Nipigon and Black Bay on Lake Superior. Infestations will probably continue to decline in the Thunder Bay District but severe defoliation is likely to persist around Lac des Mille Lacs, along the Minnesota border and in a number of other scattered pockets. Infestations will probably persist at somewhat reduced levels in the Atikokan District.

Table 1. Comparison of spruce budworm egg-mass densities in Ontario in 1986 and 1987.

OMNR Region	No. of locations sampled in 1987	No. of locations common to 1986 and 1987	Average egg-mass density per 9.29 m^2		Change (%)
			1986	1987	
Northwestern	147	98 (2)[a]	647	382	-41
North Central	220	160 (13)[a]	248	112	-55
Northern	47	39	17	1	-94
Northeastern	29	29	16	2	-89
Southern Ontario[b]	20	20	7	5	-27
Total	453	346	301	160	-47

[a] includes 15 locations aerially sprayed with *B.t.* in 1987
[b] Southern Ontario includes the Algonquin and Eastern regions.

Table 2. Comparison of spruce budworm egg-mass densities in the Northwestern Region in 1986 and 1987.

District	No. of locations common to 1986 and 1987	Average egg-mass density per 9.29 m^2		Change (%)
		1986	1987	
Dryden	19	882	377	-57
Fort Frances	22	566	275	-51
Ignace	16 (1)[a]	212	375	+44
Kenora	18	1,423	643	-55
Red Lake	12	98	404	+312
Sioux Lookout	11 (1)[a]	370	169	-54
Total	98	647	382	-41

[a] includes two locations aerially sprayed with *B.t.* in 1987

Table 3. Comparison of spruce budworm egg-mass densities in the North Central Region in 1986 and 1987.

District	No. of locations common to 1986 and 1987	Average egg-mass density per 9.29 m^2		Change (%)
		1986	1987	
Atikokan	67	530	393	-26
Geraldton	19	66	7	-90
Nipigon	25 (3)[a]	342	160	-53
Terrace Bay	34	189	35	-82
Thunder Bay	67 (10)[a]	233	99	-57
Total	160	248	112	-55

[a] includes 13 locations aerially sprayed with *B.t.* in 1987

Jack Pine Budworm, *Choristoneura pinus pinus* Free.

In 1987, jack pine budworm infestations collapsed in the province except in the Northwestern Region, in which the area of moderate-to-severe defoliation declined from 1,554,139 ha in 1986 to 504,749 ha. The largest infestation was located in the Nungesser Lake area of Red Lake District, in which 163,532 ha of moderate-to-severe defoliation were mapped. A second large pocket (47,172 ha) straddled the Sioux Lookout-Red Lake district boundary in the Aerofoil Lake area. The remainder of the defoliation consisted of numerous pockets ranging in size from a few hectares to 26,532 ha scattered throughout the Red Lake, Sioux Lookout, Kenora, Dryden, Ignace and Fort Frances districts.

Surveys for damage caused by jack pine budworm revealed some 2,000 ha of top kill and tree mortality in the Red Lake District, consisting of a number of scattered pockets in the Red Lake-Barrens Lake area. Counts of damaged trees in this area showed tree mortality ranging from 2 to 24% and top kill from 0 to 11%. The most extensive damage recorded was at Bulging Lake, where 24% tree mortality and 5% top kill were recorded. A single evaluation at Norway Lake in Kenora District disclosed 11% tree mortality and 9% bare tops. Surveys in other areas of the province show that, with the collapse of the infestation, damage levels remained unchanged over those of 1986.

In a jack pine budworm egg-mass sampling program carried out in the fall of 1987, some 252 locations were sampled, 199 of them in the Northwestern Region. An analysis of the results shows a province-wide reduction of 75% in egg-mass densities (Table 4). In all areas except the Northwestern Region, populations have returned to endemic levels and little or no defoliation is expected in 1988. In the Northwestern Region, a comparison of 97 locations sampled in 1986 and 1987 shows a

region-wide reduction of 73% in egg-mass densities. On the basis of these results and historical records of earlier outbreaks, the infestations in this region will probably decline markedly in 1988, although some small, scattered pockets of light or moderate defoliation may persist in a few areas such as the Nungesser Lake area of Red Lake District and the east-central portion of Dryden District. Large, extensive areas of moderate-to-severe defoliation are not expected in 1988.

Table 4. Comparison of jack pine budworm egg-mass densities in Ontario in 1986 and 1987.

OMNR Region	No. of locations sampled in 1987	No. of locations common to 1986 and 1987	Average egg-mass density per 9.29 m^2		Change (%)
			1986	1987	
Northwestern	199	97 (7)[a]	6.4	1.7	-73
North Central	12	7 (13)[a]	4.3	0.3	-93
Northern	13	8	0.3	0	-100
Northeastern	22	17	1.0	0	-100
Southern Ontario[b]	6	6	0.5	0.2	-66
Total	252	135	5.0	1.3	-75

[a] includes seven locations aerially sprayed with *B.t.* in 1987
[b] Southern Ontario includes the Algonquin and Eastern regions.

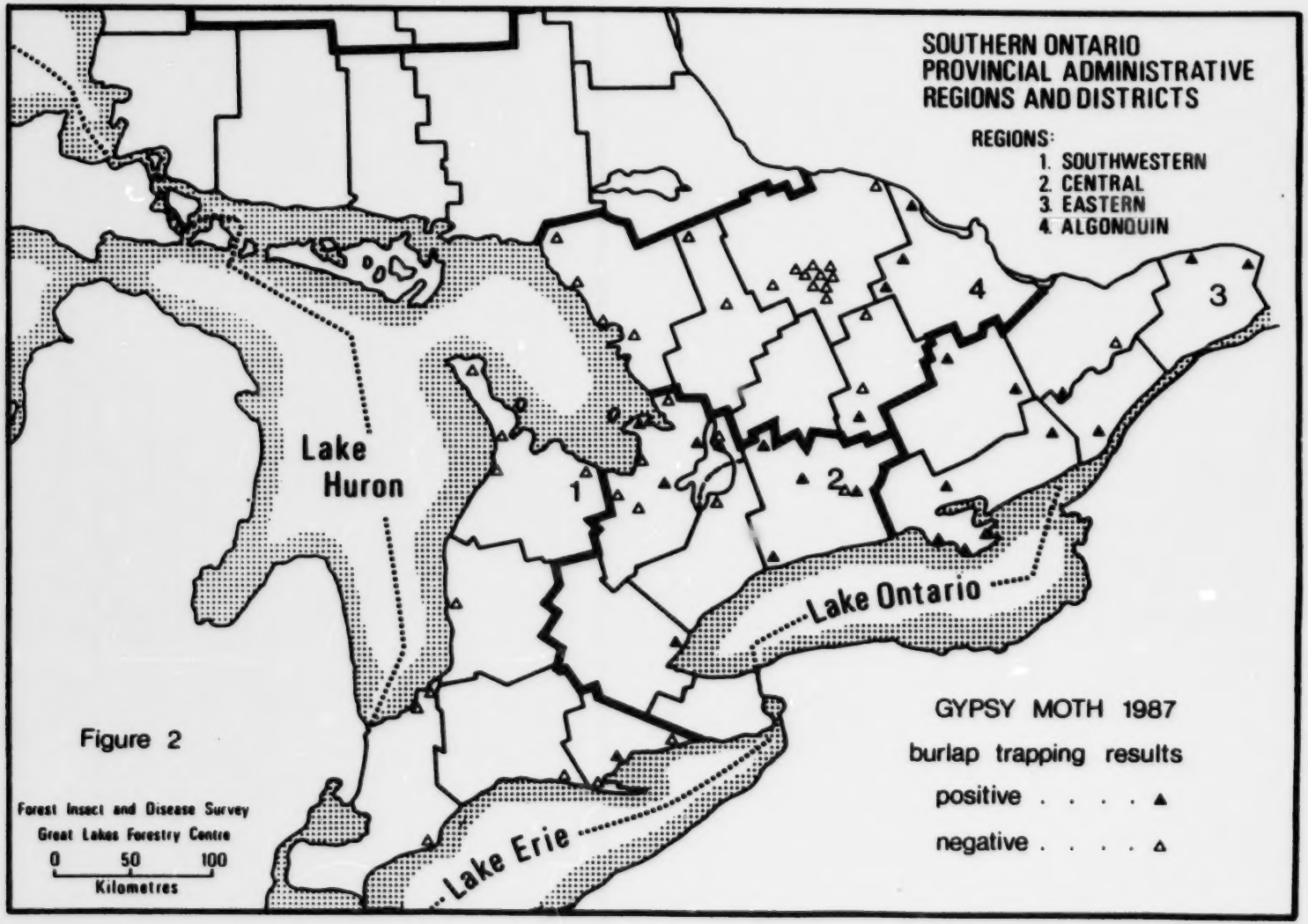
Gypsy Moth, *Lymantria dispar* L.

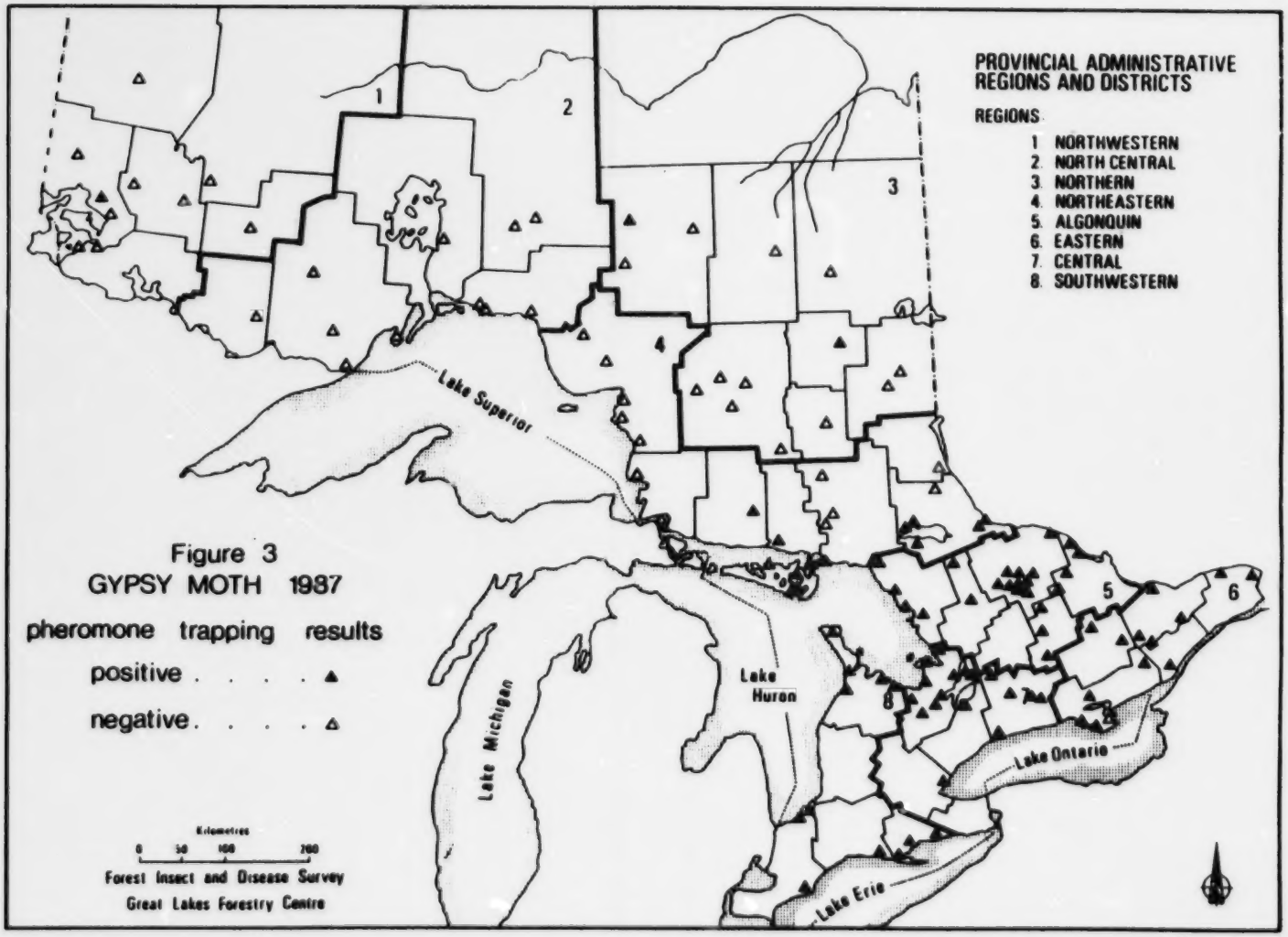
The area of moderate-to-severe defoliation caused by gypsy moth decreased by over 90%, from 167,776 ha in 1986 to 12,678 ha in 1987. Most of this decrease occurred in the central parts of the Tweed and Napanee districts, where the infestation had been present for a number of years. The bulk of the defoliation in 1987 consisted of scattered pockets extending from the western portion of Carleton Place and Brockville districts westward through the Tweed and Napanee districts to the southwestern portion of Lindsay District. In spite of the large decline in the extent of defoliation the insect continues to expand its range. The area of moderate-to-severe defoliation actually increased in the Lindsay District from 417 ha in 1986 to 888 ha in 1987, and small numbers of larvae were found in two previously uninfested areas in the Pembroke District. Small numbers of larvae were also observed in numerous other areas in the Lindsay District and the southern Minden District and at several locations in the Maple and Huronia districts. Light infestations were present in several woodlots in the Niagara District and a medium-to-heavy infestation occurred in several lots in South Walsingham Township, Simcoe District.

For the fifth consecutive year, a burlap larval trapping program was carried out in provincial parks in southern Ontario by the Forest Insect and Disease Survey (FIDS) Unit and the OMNR Parks Branch (Fig. 2). The burlap traps are installed by FIDS rangers and monitored by Parks personnel. Captures of larvae are confirmed by FIDS insect identification staff. The trapping technique takes advantage of the habit of gypsy moth larvae of descending trees to hide during the day. A folded strip of burlap tied around the tree provides a hiding place for the larvae in which they are easily captured.

In the past, results were recorded as positive or negative and no effort was made to count the number of larvae captured. However, in 1987, the procedure was modified so that traps in parks within active infestations were examined on four specific dates within a specified daily time period and all larvae were counted. Parks examined in this way included Sharbot Lake, Silver Lake, Bon Echo, Charleston Lake, Frontenac, Presqu'ile, Sandbanks, Murphy's Point and Turkey Point. Similar counts of larvae were carried out in parks on the fringes of active infestations in which small populations were known to be present; however, in these areas, daily checks of larvae were also maintained. Parks monitored in this fashion included Carillon, Ferris, Fitzroy, Lake on the Mountain, Rideau River, Bonnechere, Petroglyphs, Darlington, Emily, Serpent Mounds, Bronte Creek and McRae Point. All other parks were monitored on a daily basis as usual. It is hoped that this program will provide quantitative data on trapping of larvae in infestations of varying degrees of intensity. In parks in which larvae were captured, the total number captured averaged 210.5, and ranged from 0 at Rideau River Provincial Park, Carleton Place District, to a high of 2,135 at Sharbot Lake Provincial Park, Tweed District. Results have not yet been received from Silver Lake and Fitzroy provincial parks. The significance of these numbers should become more evident as a data base is built up over a number of years. Larvae were captured at all locations in the Eastern Region in which traps were set, with the single exception of Rideau River Provincial Park in Carleton Place District (Fig. 2). Positive results were obtained at four of the 23 locations in the Algonquin Region in which traps were set; these included new larval records at Carson Lake Provincial Park and the Petawawa National Forestry Institute (PNFI) in the Pembroke District. In the Central Region, larvae were caught at nine of 16 locations, and new records were established at Balsam Lake Provincial Park, Lindsay District, and Awenda, Bass Lake, and Springwater parks, Huronia District. Larvae were captured at only one of 12 parks in the Southwestern Region, namely Turkey Point Provincial Park, where an active infestation is known to be present.

An adult pheromone trapping program was carried out in southern Ontario in the same parks in which the burlap trapping took place, as well as in a few other locations (Fig. 3). As in other years, two pheromone traps were deployed in each park, with one located in a camping area and the other near the park entrance. Ten pheromone traps each were deployed at Canadian Forces Base (CFB) Borden, CFB Petawawa and the Tank Range at Meaford. This year's program yielded moths at 65 locations in which one


SOUTHERN ONTARIO
PROVINCIAL ADMINISTRATIVE
REGIONS AND DISTRICTS
REGIONS:
1. SOUTHWESTERN
2. CENTRAL
3. EASTERN
4. ALGONQUIN
Lake Huron
Lake Ontario
Lake Erie
1
2
3
4
GYPSY MOTH 1987
burlap trapping results
positive . . . . ▲
negative . . . . △
Figure 2
Forest Insect and Disease Survey
Great Lakes Forestry Centre
0 50 100
Kilometres


PROVINCIAL ADMINISTRATIVE
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REGIONS
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5. ALGONQUIN
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7. CENTRAL
8. SOUTHWESTERN
Lake Superior
Lake Michigan
Lake Huron
Lake Ontario
Lake Erie
Figure 3
GYPSY MOTH 1987
pheromone trapping results
positive . . . . ▲
negative. . . . △
Kilometres
0 50 100 200
Forest Insect and Disease Survey
Great Lakes Forestry Centre

or more traps were recovered (Fig. 3). At a few locations, all the traps were destroyed or stolen. The average number of moths per trap increased marginally from 15.3 in 1986 to 15.7 in 1987. However, in the Eastern Region, in which widespread heavy infestation declined drastically this year, the average number of moths per trap was reduced from 32.2 in 1986 to 16.2 in 1987. In most other areas moth catches were similar to those of 1986, with the exception of Algonquin Park District, in which catches increased from 5.3 to 12.7 moths/trap and Owen Sound District, in which catches increased from 4.7 to 12.1 moths/trap. In Aylmer District, catches at a single location increased from 6 to 18.5 moths/trap. Trapping at CFB Borden yielded 18.8 moths/trap, at CFB at Petawawa 19.6/trap and at the Meaford Tank Range 7.4/trap. These results may be particularly significant because of the high potential for spread from these areas as a result of the constant movement of personnel and equipment to other parts of the country.

A similar pheromone trapping program was carried out in northern Ontario in most provincial parks and campgrounds and some private ones. Methods are similar in that two traps are placed in each park, one in a camping area and one near the entrance. However, in northern Ontario, where there are no known infestations, 10 traps are deployed in any parks in which moths were caught in the previous year. The highest and most consistent moth catches in northern Ontario were in the North Bay, Sudbury and Espanola districts of the Northeastern Region. In Espanola District on Manitoulin Island, moth catches were made at South Bay Resort and Red Lodge for the third and fourth consecutive years, respectively. Small numbers of moths were captured at Chutes Provincial Park for the second consecutive year and three moths were caught on Birch Island in Curtin Township. The largest catches in Espanola District were at South Bay Resort, where the average number of moths/trap increased from 1.6 in 1986 to 6.0 in 1987. In Sudbury District the extra traps installed at Fairbank and Windy Lake provincial parks failed to duplicate the positive catches of 1986. However, at Killarney Provincial Park, a marked increase from 1.6 to 21 moths per trap was recorded. In North Bay District, moths were caught for the second consecutive year at Restoule and Samuel de Champlain provincial parks, and for the third consecutive year at Antoine Provincial Park. Results were negative at Martin River Provincial Park, where a single moth was captured in 1986. Single moths were caught at the following locations in northern Ontario in 1987: Fushimi Provincial Park, Hearst District; Kettle Lakes Provincial Park, Timmins District; Mississagi Provincial Park, Blind River District; and Rushing River Provincial Park, Kenora District. Moth catches made in 1986 at Wakami and Mississagi Wild River parks, Chapleau District, and Kap Kig i Wan Provincial Park, Kirkland Lake District were not repeated in 1987 despite the deployment of additional traps.

A survey was carried out in October by crews under CFS supervision to determine egg-mass densities in plots used to assess the efficacy of the 1987 aerial spraying program. In all, 107 plots were

checked in the Eastern and Algonquin regions. Overall results indicate that egg-mass densities declined by some 58% over 1986 levels. On the basis of this survey it appears that further reductions in the area of moderate-to-severe defoliation can be expected in 1988. Small scattered pockets of moderate-to-severe defoliation will probably persist in such areas as Kaladar, Marble Rock and Kashabog Lake in the Tweed District, but extensive areas of heavy defoliation are unlikely. Further west, FIDS rangers encountered gypsy moth egg masses in a number of areas during day-to-day surveys. In the Lindsay District, high numbers of egg masses were found in numerous areas in the Northumberland and Ganaraska county forests and five egg masses were detected in Balsam Lake Provincial Park. Small numbers (two to five egg masses) were detected at two locations in the Minden District and in Killbear Provincial Park, Parry Sound District. Egg masses were plentiful in the southwestern corner of the main tract of the Durham Regional Forest, Maple District, and a few were detected in a golf course at Midland in Huronia District. In the Southwestern Region, small numbers of egg masses were detected on roadside bur oak at one location in Walpole Township, and very high numbers occurred at a second location in South Walsingham Township in the Simcoe District. In addition, egg masses were confirmed at one campsite in Wheatley Provincial Park in the Chatham District. Small numbers of egg masses were also found at CFB Petawawa and at two locations at PNFI in the Pembroke District. It should be noted that OMNR conducted a more extensive egg survey in eastern Ontario this fall; however, the results of this survey are not yet available.

Forest Tent Caterpillar, *Malacosoma disstria* Hbn.

Forest tent caterpillar infestations continued to expand in 1987, for the third consecutive year. All together, 1,649,977 ha of moderate-to-severe damage were mapped in the province, up from 433,000 ha in 1986. The bulk of the infestation is located in the Northeastern and Algonquin regions. This consists of two large infestations, one located along the Quebec border in North Bay and Temagami districts of the Northeastern Region and in the southeastern corner of Kirkland Lake District in the Northern Region, and the other on the eastern shore of Georgian Bay in Parry Sound and Bracebridge districts of the Algonquin Region, with a small extension into Huronia District of the Central Region. Numerous smaller pockets of moderate-to-severe damage occurred from the city of Sault Ste. Marie eastward through Sault Ste. Marie, Blind River, Espanola and Sudbury districts and the western North Bay District. Similarly, numerous smaller pockets were recorded in Parry Sound, Bracebridge, Minden and Bancroft districts of the Algonquin Region. Small pockets of infestation were also mapped in Tweed and Carleton Place districts of the Eastern Region, Kirkland Lake and Chapleau districts of the Northern Region and Wawa District of the Northeastern Region. Further west, small patches of moderate-to-severe defoliation occurred in Terrace Bay and Thunder Bay districts of the North Central Region and numerous pockets occurred in Fort Frances District of the Northwestern Region.

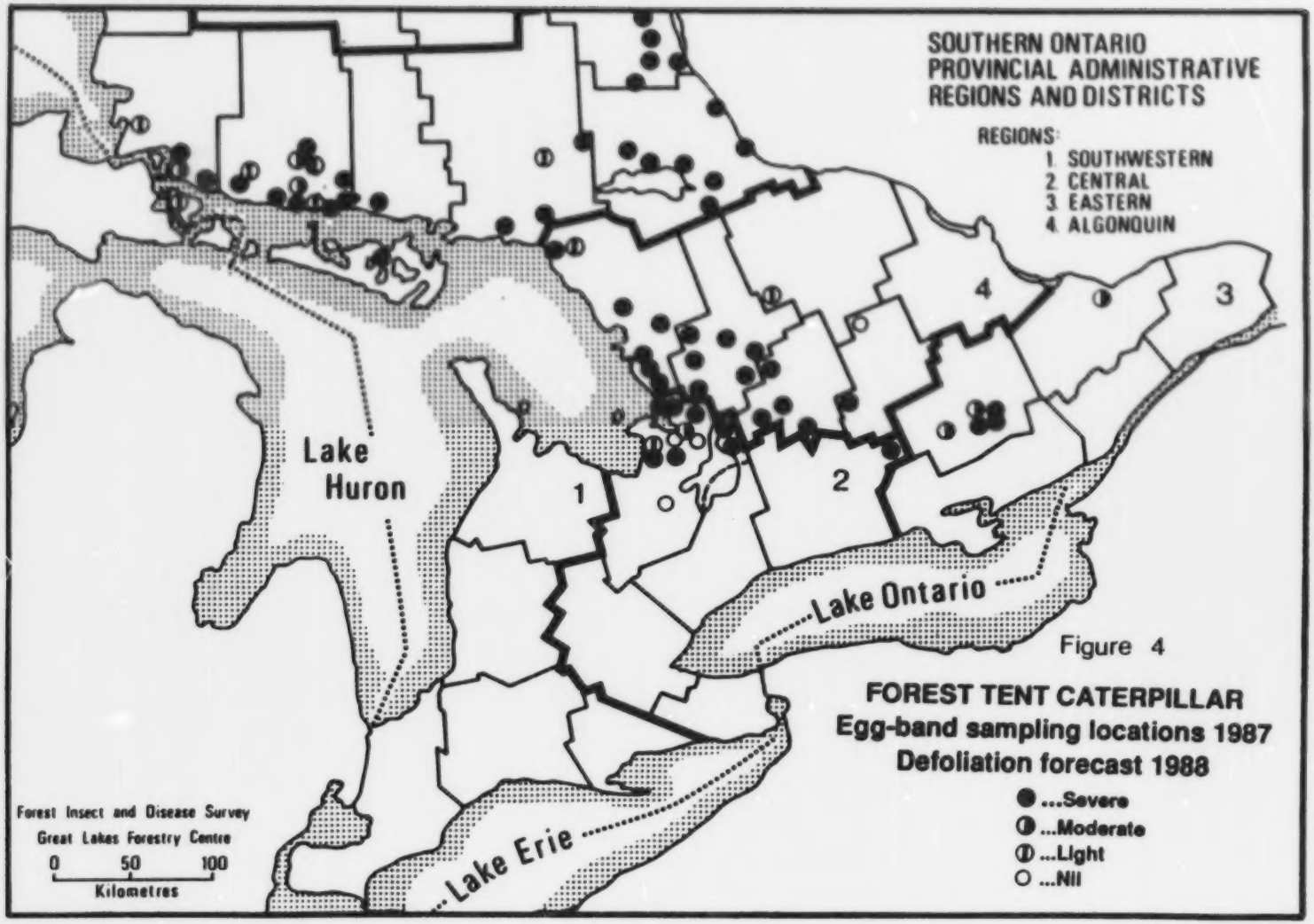
Egg-band sampling was carried out in the fall of 1987 for the purpose of forecasting forest tent caterpillar populations in 1988 (Fig. 4, 5 and 6). The results indicate that infestations will remain heavy in most of the areas described in the Northeastern and Algonquin regions and, indeed, many of the smaller pockets may coalesce to form fewer but larger blocks of moderate-to-severe defoliation. In contrast, infestations in southeastern Kirkland Lake District, which was one of the first areas to sustain defoliation in the current outbreak, are expected to begin declining in 1988, with light defoliation forecast for many of the areas that were heavily infested in 1987. Infestations are expected to persist at high levels and possibly expand somewhat in northern Huronia District and a similar situation will likely prevail in areas infested in Tweed and Carleton Place districts. Populations will probably persist at about the same levels in western Wawa District and in adjacent areas of Terrace Bay District and two small pockets in southern Thunder Bay District will probably decline or disappear in 1988. Infestations in western Atikokan District and adjacent Fort Frances District will probably expand and it is possible that many of these small pockets will coalesce to form much larger infestations next year.

Redheaded Pine Sawfly, *Neodiprion lecontei* (Fitch)

Population levels of this serious pest of red pine varied in the province in 1986. The highest numbers were recorded in Parry Sound District, where increased populations prompted OMNR to hand spray some 47 plantations for the pest. In all, 200 ha were treated with Leconte virus and an additional 460 ha were treated with malathion. Increased populations also occurred in the Bancroft, Algonquin Park and Pembroke districts, with the highest numbers in Dungannon and Mayo townships, Bancroft District, where single, small plantations had 43 and 34% of the trees infested, respectively. A heavy infestation recurred on scattered 2-m windbreak red pine in Floss Township, Huronia District where defoliation as high as 100% was recorded. In the Eastern Region, a general decline in numbers was evident, with only one plantation requiring control measures. This was in Darling Township, Carleton Place District, where 26% of the trees suffered an average of 15% defoliation. Increased but generally small populations were reported from a number of districts in the Northeastern Region. The highest populations were evident in Hallam and Baldwin townships, Espanola District and in Olrig and Bonfield townships, North Bay District, where hand spraying with malathion was carried out.

Pine Cone and Shoot Beetles, *Conophthorus banksianae* McP., *C. resinosae* Hopk. and *C. coniperda* (Sz.)

Heavy infestations of the jack pine tip beetle, *Conophthorus banksianae*, were again reported in Lane and Timbrell townships, Blind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REGIONS:
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Lake Erie
1
2
3
4
Forest Insect and Disease Survey
Great Lakes Forestry Centre
0 50 100
Kilometres
FOREST TENT CATERPILLAR
Egg-band sampling locations 1987
Defoliation forecast 1988
...Severe
...Moderate
...Light
...Nil

Figure 4

NORTHEASTERN ONTARIO

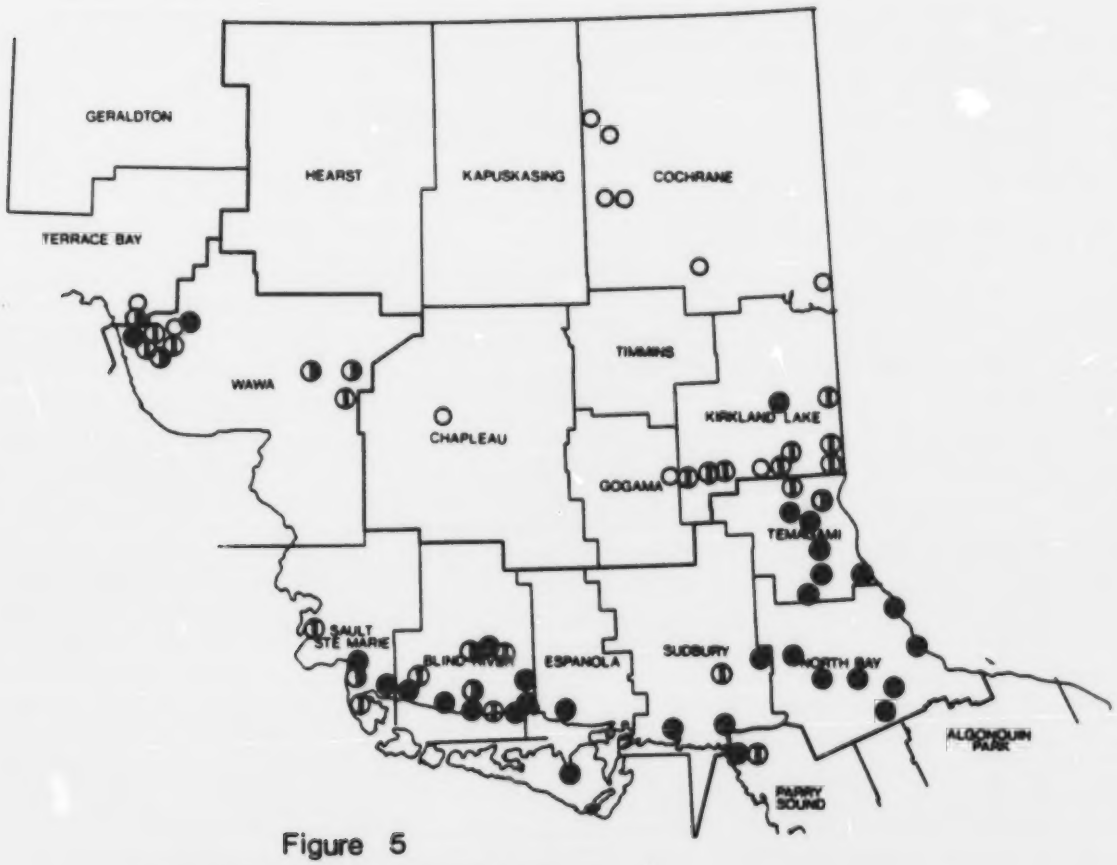

Figure 5

FOREST TENT CATERPILLAR
Egg-band sampling locations 1987
Defoliation forecast 1988

- ● ...Severe
- ◑ ...Moderate
- ◐ ...Light
- ○ ...Nil

0 Miles 60

0 Kilometres 96

Forest Insect and Disease Survey
Great Lakes Forestry Centre

NORTHWESTERN ONTARIO

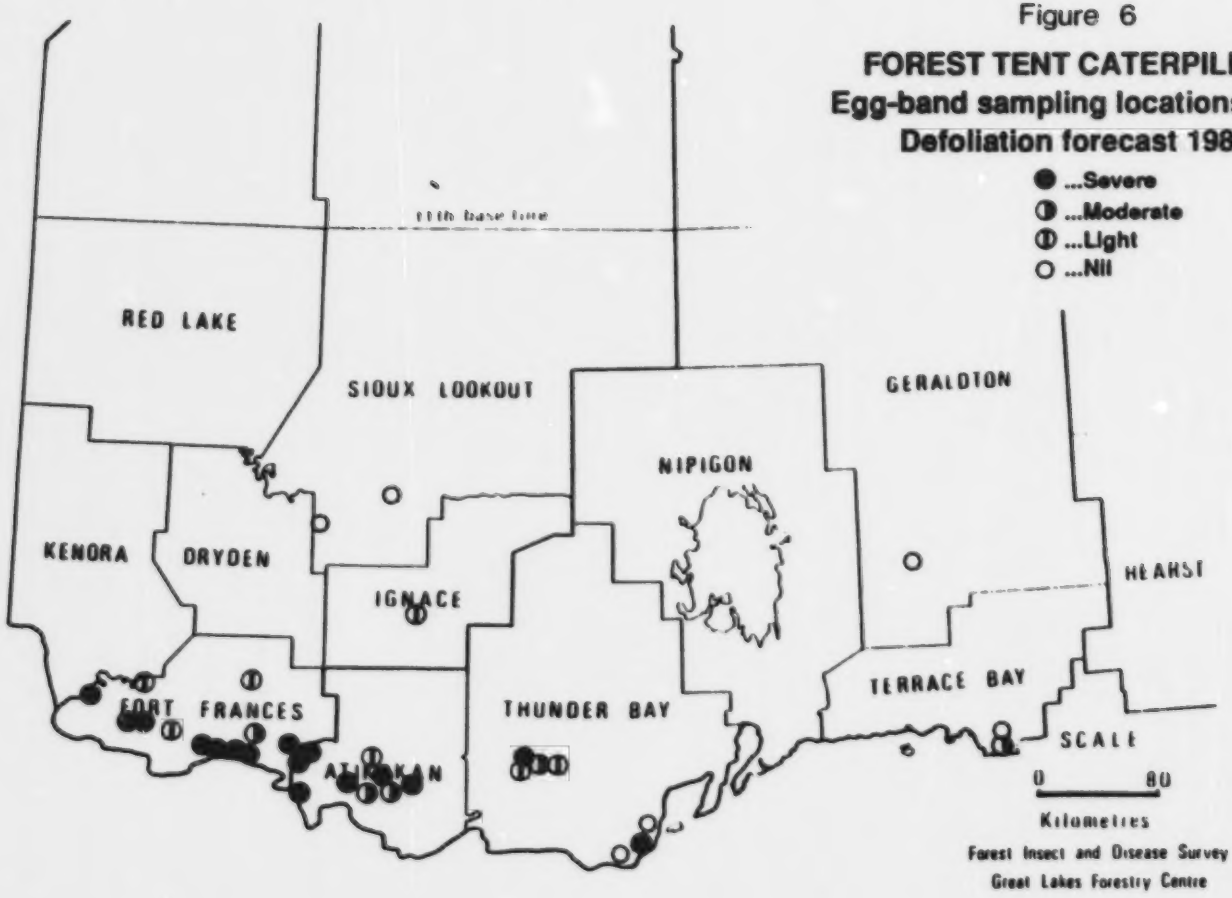

Figure 6

FOREST TENT CATERPILLAR
Egg-band sampling locations 1987
Defoliation forecast 1988

- ● ...Severe
- ◑ ...Moderate
- ◐ ...Light
- ○ ...Nil

River District. Several evaluations in Lane Township revealed incidence ranging from 41 to 58% and leader damage as high as 8%. Leader damage of 8.5% occurred in Langlois Township, Chapleau District, where the insect was found commonly in small numbers. Light infestations were also reported in Trill Township, Sudbury District, on the Stanton Lake Road, Atikokan District, in Hurlburt Township, Sault Ste. Marie District, near Goodie Lake, Sioux Lookout District, and along the Dixie Lake Road, Red Lake District.

A heavy infestation of the red pine cone beetle, *C. resinosae*, persisted on shoreline and island trees on Lake Temagami, Temagami District. Light damage in the 5% to 10% range occurred in a camping area on Pretty Lake, Algonquin Park District, and very low populations were apparent on poorly growing red pine in a number of other areas in the same district.

Heavy infestations of white pine cone beetles were noted on several islands in Georgian Bay in the Sans Souci area of Parry Sound District. Cones were severely damaged and the insect is suspected of causing up to 75% shoot damage on 8-m to 10-m white pine in the same area. The insect was also reported damaging cones on mature white pine at the Angus tree seed plant in Huronia District.

Birch Sawfly, *Arge pectoralis* (Leach)

This sawfly caused heavy defoliation in a 15-ha white birch stand in McKim Township, Sudbury District, and complete defoliation of an additional 40 ha of white birch in Neelon and Dryden townships, Sudbury District. The insect was also prevalent in the Eastern Region, where open-grown clumps of trees in many locations suffered defoliation in the 50% range. Heavier damage was recorded on shoreline trees at Robertson Lake in Lavant Township, Carleton Place District, and in Charleston Lake Provincial Park, Brockville District, where defoliation of 80% and 75%, respectively, was recorded.

Yellowheaded Spruce Sawfly, *Pikonema alaskensis* (Roh.)

Surveys in the latter part of the field season revealed a number of areas of moderate-to-severe damage to white spruce plantings in Thunder Bay and Atikokan districts. The most serious infestation occurred on black spruce in the O'Connor Seed Orchard, which was sprayed twice by OMNR personnel to curtail feeding damage. Other infestations with defoliation ranging as high as 75% were reported on open-grown and fringe trees in Paipoonge Township, at Kakabeka Falls Provincial Park, in the Shebandowan area and near English River in Thunder Bay District, and at one location at French Lake in Atikokan District. A single black spruce plantation sustained moderate-to-severe defoliation at Burrows Lake in Geraldton District. The insect was also reported at various but

generally low population levels in the Northeastern Region; the most severe damage (100% defoliation) occurred on roadside white spruce in Aberdeen Township, Sault Ste. Marie District. Small infestations with defoliation in the 50% to 70% range were recorded on white spruce trees in Sproule Township, Algonquin Park District and Cardiff Township, Bancroft District.

Oak Skeletonizer, *Bucculatrix ainsliella* Murt.

Larval populations of both the first and second generations of this insect declined to generally low levels in the Central and Southwestern regions. The highest numbers were recorded in one 10-ha red oak stand in the Thornton Bales Conservation area in King Township, Maple District. The insect was widespread on red and black oak in the Niagara and Aylmer districts, and to a lesser extent in the Chatham District, but in all cases defoliation did not exceed 7%. Widespread, small populations were present in a number of red, white, black and bur oak stands in the Eastern Region.

Oak Leaf Shredder, *Crocsia semipurpurana* (Kft.)

An increase in numbers of this insect was reported in Maple and Huronia districts of the Central Region, and in Sault Ste. Marie and Blind River districts of the Northeastern Region. The highest populations occurred in Tiny Township, Huronia District, and in Uxbridge Township, Maple District. Egg counts and pheromone trap surveys were completed in the latter part of the field season and these indicate that moderate-to-severe defoliation can be expected at a number of locations in Awenda Provincial Park in Tiny Township, Huronia District, and in the Durham Regional Forest in Uxbridge Township, Maple District. Moderate defoliation is also predicted at one location in Long Township and severe defoliation could occur at another location in Thessalon Township, Blind River District.

Sawyer Beetles, *Monochamus* spp.

Heavy feeding by adult sawyer beetles caused approximately 10 ha of mortality of jack pine and black spruce adjacent to cut-over areas near McWhinney Lake in Thunder Bay District. Aerial surveys also disclosed a total of about 40 ha of dead jack pine in similar situations near Mameigwess Lake, Bradshaw Township, Ignace District, and near Crescent and Tea lakes in Slaght and Barrett townships, Sioux Lookout District. About 5 ha of jack pine mortality were mapped near Leitch Lake, Red Lake District.

Fall Webworm, *Hyphantria cunea* (Dru.)

Populations continued to decline in much of southern Ontario. Infestations that caused defoliation from 30% to 75% last year in some areas of the Parry Sound, Lindsay and Huronia districts were reduced to small numbers of scattered tents on a variety of deciduous hosts. A similar decline was evident in previously infested areas in the Pembroke and Bancroft districts. Populations were also generally low in the Central and Southwestern regions with the exception of one location on the Niagara Parkway, Niagara District, and another along Highway 24 in Charlotteville Township, Simcoe District, where black walnut and other deciduous hosts supported medium-to-high populations. In contrast, populations remained generally high in the Eastern Region, with numerous small pockets of medium and heavy infestation reported in the Cornwall, Carleton Place, Brockville, Napanee and Tweed districts.

In northern Ontario, numbers were generally low except in Sudbury, North Bay and Espanola districts of the Northeastern Region. Small pockets of trees were heavily defoliated in these districts, with the most extensive damage occurring along Highway 17 north of Lake Nipissing in the Beaucage-Commanda townships area.

Maple Trumpet Skeletonizer, *Epinotia aceriella* (Clem.)

This late-summer insect was widespread in the Southwestern Region and in Niagara District of the Central Region. However, in all cases, numbers were very low and foliar damage did not exceed 5%. In the Eastern Region, a 10-ha sugar maple stand in Presqu'ile Provincial Park sustained 85% foliar damage on understory trees and the lower crowns of mature trees. A 2-ha sugar bush in Hallowell Township, Napanee District, suffered approximately 65% defoliation. The insect was also observed causing less than 10% defoliation in a few areas in Brockville District. It was not reported elsewhere in the province.

Eastern Pine Shoot Borer, *Eucosma gloriola* Heinr.

Widespread but small populations of this pest of pine were reported across northern Ontario and in Pembroke and Bancroft districts in southern Ontario. In the Northern Region, where the insect has been most prevalent in recent years, leader damage averaged 2% at 10 widely separated locations. The most severe damage reported this year occurred in a 20-ha jack pine stand in Dalmas Township, Chapleau District, where 4% of the leaders were destroyed on 2-m trees. Seventeen percent of the trees were infested in a 10-ha white pine plantation in Burwash Township, Sudbury District; however, as no leaders were affected on the 3-m trees at this location, the damage was of little consequence. The insect was also reported from numerous other locations, but in most instances leader damage was less than 2%.

Maple Leafcutter, *Paraclemensia acerifoliella* (Fitch)

Infestation levels of this late-season pest of sugar maple remained high in Laxton Township, Minden District, where semimature trees in an 8-ha stand sustained 90% defoliation. Heavy infestations were also recorded for the third year in a 4-ha sugar bush in Lanark Township, Carleton Place District, where defoliation levels of 80% were recorded. Eighty percent defoliation was also recorded in a sugar maple stand in Oxford on Rideau Township, Carleton Place District. Damage was somewhat less severe in a number of other areas in Brockville and Carleton Place districts, as well as in Napanee and Tweed districts, with defoliation ranging from 10% to 60%. Populations declined markedly in a 10-ha portion of a sugar bush in Wilberforce Township, Pembroke District, where 20% defoliation was observed on the understory and lower crowns of larger trees. Populations declined to trace levels in a previously heavily infested maple stand in Limerick Township, Bancroft District. Similar trace levels of damage were detected in sugar maple stands in Faraday Township, Bancroft District, and Blithfield Township, Pembroke District.

Aspen Leafblotch Miner, *Phyllonoryeter ontario* (Free.)

Generally small and declining populations of this late-season pest of trembling aspen were reported from the Northwestern, North Central and Northern regions. In spite of this, high populations persisted in a few areas, mainly in the Northwestern Region. Forest edge and roadside trees suffered up to 100% defoliation at km 28 on the Vermilion River Road, Sioux Lookout District, and at one location on the Nungesser Road, Red Lake District. Foliar damage levels up to 100% were recorded at a number of locations along highways 11 and 17, and foliar damage of 86% occurred near Cuttle Lake in Fort Frances District. Large populations were noted at two locations in Thunder Bay District and at single locations in Atikokan, Nipigon and Geraldton districts. Damage in most other areas was reported at trace or low levels.

Pine False Webworm, *Acantholyda erythrocephala* (L.)

Surveys during the latter part of the field season turned up a number of additional infestations of this plantation pest. The most noteworthy of these was located in Ramsay Township, Carleton Place District, where two small blocks of red pine 4 ha and 5 ha in size sustained defoliation of 92% and 25%, respectively. Approximately 2% tree mortality was apparent at the latter plantation, which was located on a dry site. In Mayo Township, Bancroft District, 20% of the trees in a 15-ha red pine plantation were 50% defoliated, and in Monteagle Township of the same district 15% defoliation was recorded on 30% of the trees in a 1-ha red pine plantation.

White Pine Weevil, *Pissodes strobi* (Peck)

In northern Ontario, this insect was most prevalent in the Chapleau, Gogama, Timmins, Temagami and Kirkland Lake districts of the Northern Region. Evaluations in 22 young jack pine, one black spruce and two white spruce plantations in the Northern Region showed an incidence of infested leaders ranging from 0 in Warren Township, Chapleau District, to 37.3% in Michie Township, Kirkland Lake District. Infested leaders in these areas averaged 12.5%. Other locations in which relatively high populations were found were on the Dixie Lake Road, Red Lake District (20% leader damage), at Big Sawbill Lake and Otter Falls, Fort Frances District (18.7% and 18.0% leader damage) and on the Snake Bay Road, Dryden District (16% leader damage). The insect was reported from numerous other areas in northern Ontario, but in almost all cases leader damage was less than 10%. Ground spraying with the chemical methoxychlor was carried out in Scots pine and jack pine plantations in Tennyson and Hallam townships, Espanola District, with the result that the percentage of infested leaders declined from 14% in 1986 to 1.2% in 1987.

In southern Ontario, leader damage varied widely, with the highest percentage of infested leaders (60%) observed in a 2-ha, 3.8-m experimental Norway spruce plantation at PNFI in Buchanan Township, Pembroke District. In addition, 36% and 18.7% leader damage was recorded in small white pine plantations in Ross and Wilberforce townships, respectively. The only other significant leader damage reported in southern Ontario was in Madoc Township, Tweed District, where 32% of the trees were affected. Although numbers remained generally low in the Southwestern Region, marginal increases were recorded at a number of locations in the Simcoe District and at one location in Turnberry Township, Wingham District, where the incidence of attack increased from 0 in 1986 to 14% in 1987.

Greenstriped Mapleworm, *Dryocampa rubicunda rubicunda* (Fabr.)

A general increase in numbers of this insect was evident in the Fort Frances District, where light infestations were detected in red maple stands in the Reeves Lake-Barber Lake area. The average defoliation was approximately 10% on infested trees, but some individual trees in infected stands had defoliation as high as 70%. Light-to-moderate damage, with defoliation as high as 80%, was recorded on red maple in a 40-ha stand in Cadeau Township and in a 20-ha stand in Burpee Township, Espanola District. The insect caused moderate-to-severe defoliation (50% to 75%) in a 1-ha sugar maple stand near Flack Lake in Raimbault Township, Blind River District. Light defoliation was evident on sugar maple along Highway 646 near Constance Lake in Parkinson Township, Blind River District.

Swaine Jack Pine Sawfly, *Neodiprion swainei* Midd.

This potentially serious pest caused moderate-to-severe defoliation of a small jack pine stand on Island 127 in Lake Temagami, Temagami District, where an infestation has persisted for several years. In addition, small numbers of colonies were observed at other locations in Lake Temagami in Phyllis, Joan and Canton townships, and in jack pine plantations in Gamble, McGiffin and Selby townships, also in the Temagami District. Small numbers of colonies were observed along the French River in Bigwood Township and on the southeastern shore of Barlow Lake in Jennings Township, Sudbury District.

Black Army Cutworm, *Actebia fennica* (Tausch.)

No infestations of this insect were detected in 1987 except at one location in the Thunder Bay Forest Tree Nursery, where a heavy infestation caused light damage to black spruce seedlings.

A pheromone trapping program was carried out in susceptible tree planting sites in the Hearst, Chapleau and Gogama districts, and at the Thunder Bay Forest Tree Nursery. In all cases either results were negative or only small numbers of moths were caught, except at the Thunder Bay Forest Tree Nursery, where six traps caught a total of 241 moths.

Solitary Oak Leafminer, *Cameraria hamadryadella* (Clem.) and
Oak Leafmining Sawfly, *Profenusa lucifex* (Ross)

The combined feeding of these two late-season insects caused moderate-to-severe foliar damage (ranging from 60% to 90%) to oak stands in the Carleton Place, Napanee and Brockville districts of the Eastern Region. In most cases the stands were small (1 to 5 ha) and most species of oak (i.e., red, white, bur and black) were attacked. The solitary oak leafminer was also reported causing 30% to 40% foliar damage to red and bur oak along Highway 169 in the Bala area of Wood Township, Bracebridge District. A light infestation occurred on roadside bur oak at Beech Lake in Stanhope Township, Minden District.

Larch Sawfly, *Pristiphora erichsonii* (Htg.)

Unusually small populations of this pest were reported from across the province in 1987. The only exception was in the Thunder Bay District, where a single heavy infestation causing 80% defoliation occurred in a 2-ha stand near Little Kabaigon Lake. Light infestations also occurred in the Thunder Bay District in the Upsala area, along Highway 11-17 in the city of Thunder Bay and at Middle Falls Provincial Park.

Mountain-ash Sawfly, *Pristiphora geniculata* (Htg.)

Infestations of this defoliator declined to unusually low levels throughout most of the province in 1987. The only exceptions to this trend were in southern Chapleau District, where ornamental and forest mountain-ash trees suffered variable defoliation as high as 65%, and in the Fort Frances District, where scattered infestations caused defoliation as high as 35%.

Flat Leaftier, *Psilocorsis reflexella* Clem.

For the second consecutive year, small but heavy infestations of this insect occurred on red and bur oak and trembling aspen stands at many locations across the Parry Sound, Bracebridge, Minden and Lindsay districts. In many cases foliar damage exceeded 75%, particularly on trees growing on poor sites with shallow or rocky soils. The insect also caused foliar damage of approximately 60% on red oak stands in Front of Escott Township, Brockville District. Small populations were detected in scattered trembling aspen stands in the southern half of the Bancroft District.

Other Noteworthy Insects

The shorthorned oakworm, *Anisota finlaysoni* Riotte, caused 80-100% defoliation of open-grown bur oak over a wide area in Trafalgar Township, Cambridge District. The closely related orangestriped oakworm, *Anisota senatoria* (J.E. Smith), caused moderate-to-severe defoliation of open-grown bur oak at single locations in Delaware, Caradoc and Ekfrid townships, Aylmer District, and in Walpole Township, Simcoe District.

Overwintering larvae of the European pine shoot moth, *Rhyacionia buoliana* (D.&S.), heavily infested 3-0 red pine seedlings in a single compartment of the St. Williams Forest Tree Nursery in Simcoe District.

Declining populations of the walnut caterpillar, *Datana integerrima* G.&R., were reported from the Southeastern Region. Defoliation in most cases was less than 20%.

A survey of sugar maple stands in the Eastern Region revealed that the sugar maple borer, *Glycobius speciosus* (Say), was present in all stands examined at infestation levels ranging from 1% to 7%.

The maple webworm, *Tetralopha asperatella* (Clem.), was widespread in the Bracebridge, Minden, Parry Sound and Lindsay districts, with defoliation as high as 30-40% in a few locations. Small populations were also observed in Rear of Yonge and Escott Township, Brockville District.

Light and occasionally medium infestations of the hickory twig pruner, *Elaphidionoides parallelus* (Newm.), occurred on bitternut hickory and red oak at a number of widespread locations in the Eastern Region.

The willow flea weevil, *Rhynchaenus rufipes* Lec., caused 100% foliar damage to small clumps of willow at numerous locations in the Eastern Region and at one location in McRae Point Provincial Park, Huronia District. Similar damage was caused by the imported willow leaf beetle, *Plagiodera versicolora* (Laich.), at a few locations in Carleton Place and Napanee districts of the Eastern Region.

Increased populations of the poplar flea beetle, *Altica populi* Brown, causing foliar damage as high as 95% were reported from several areas in the Bancroft and Pembroke districts. Similar damage was reported on trembling aspen stands on St. Joseph Island and adjacent mainland areas in Sault Ste. Marie and Blind River districts.

Unusually high populations of the greenheaded spruce sawfly, *Pikonema dimmockii* (Cress.), caused 56% defoliation of a small clump of white spruce trees at Murphy's Point Provincial Park, Carleton Place District.

Moderate defoliation of single red oak stands was caused by the oak trumpet skeletonizer, *Epinotia timidella* Clem., in each of the Minden, Carleton Place and Sault Ste. Marie districts.

Generally small populations of the redheaded jack pine sawfly, *Neodiprion virginianus* complex, were reported from the Northern and Northeastern regions.

Small populations of the introduced pine sawfly, *Diprion similis* (Htg.), were reported from single locations in each of the Huronia, Parry Sound and Napanee districts.

Large populations of the spruce spider mite, *Oligonychus ununguis* (Jac.), were found frequently on ornamental white spruce and eastern white cedar in the Maple District.

Heavy infestations of another mite, *Eriophyes* spp., caused 50-75% defoliation of 50 ha of immature trembling aspen east of Bare Tent Lake, Huotari Township, Wawa District.

The pine tortoise scale, *Toumeyella parvicornis* (Ckll.), heavily infested 25% of the trees in a small jack pine plantation in Oliver Township, Thunder Bay District. Small numbers of infested trees were also reported in Maria Township, Pembroke District, White Township, Algonquin Park District, and Bridgeland and Lefroy townships, Sault Ste. Marie District.

The saratoga spittlebug, *Aphrophora saratogensis* (Fitch), caused 2% tree mortality and an average of 10% branch mortality in a small red pine plantation in Raglan Township, Pembroke District.

TREE DISEASES

Scleroderris Canker, *Ascocalyx abietina* (Lagerb.) Schläpfer-Bernhard

Intensive surveys for the European race of this disease were carried out in Ontario in 1987. Particular attention was paid to areas in the immediate vicinity of the three known infection sites in Mayo Township, Bancroft District, Macaulay Township, Bracebridge District and McMurrich Township, Parry Sound District. As a result, four new infection sites were discovered in Mayo Township, two in Macaulay Township and three in McMurrich Township. All the 1987 finds were in the same general areas of the original discoveries of the European race and do not represent a significant extension in its range. Surveys for the European race in the remainder of the province were negative.

Reports of the North American race of this disease were scarce in 1987 and in most cases infection levels were low. The only exception was in Galbraith Township, Blind River District, where sampling in a newly discovered infection center revealed that 76% of the trees were infected. A recheck of a known infection center in Haughton Township, Blind River District, disclosed an infection rate of 60%.

Pinewood Nematode, *Bursaphelenchus xylophilus* (Steiner & Buhrer) Nickle

Surveys to date have shown that both the "r" and the "m" form of this organism are present in Ontario forests. However, from present reports there is an indication that only the less pathogenic "m" form is present on spruce and balsam fir. Surveys in 1987, therefore, concentrated on determining which forms were present on spruce and fir in Ontario. In addition, preliminary work was begun on determining the impact of the pinewood nematode on stands in which it has been found to date. Some 175 samples were submitted to the laboratory for identification. Of these, 76 contained nematodes that are still being analyzed to determine their species and form. When the analysis is completed the information will be combined with data gathered at sites at which the nematode has been collected to determine the impact of this organism on conifer stands in the province.

Maple Decline

In 1984, in response to concern about the health of sugar maple in the province, the FIDS Unit began to monitor some 24 strategically located sugar maple stands in southern Ontario for signs of dieback or decline. In that year, 6% of the trees examined showed severe dieback symptoms and an additional 16.7% showed minor symptoms. Subsequent examinations in 1985 and 1986 did not reveal any additional deterioration in the trees, and indeed, in a number of instances, an improvement in vigor and an overall recovery of most trees that had been affected

was noted. In all instances in which trees had shown decline or dieback symptoms, these were the result of agents that normally occur in the forest.

In 1987, in response to continuing concern, 70 more permanent plots were established throughout the range of sugar maple. An additional 70 are planned for 1988. The plots (25 trees each) were randomly located in mature or overmature stands. Each tree was measured and scrutinized for general crown and foliage condition, specific dieback symptoms, stem defects and various insect, disease and abiotic conditions. Of the 1,750 trees thus examined 87% were classed as healthy, 10.8% showed minor dieback symptoms, 2.0% showed moderate-to-severe dieback problems and 0.2% were dead. In all cases the damage to the trees was the normal deterioration expected in stands of these age classes. The plots will be examined annually.

Beech Bark Disease, *Nectria coccinea* var. *faginata* Lohm Wats & Ay.

Surveys were carried out in southern Ontario for this disease and its vector, the beech scale, *Cryptococcus fagisuga* Lindinger. Although the insect vector was collected at several locations in the Maple, Cambridge and Brockville districts, surveys for the fungus were negative, with one possible exception. At Presqu'ile Provincial Park, Napanee District, a single sample of *Nectria coccinea* was collected; however, there is some doubt about whether the sample was of the variety that causes beech bark disease.

Foliage Diseases of Poplar, *Mycosphaerella populorum* G.E. Thomson, *Linospora tetraspora* G.E. Thomson, *Marssonina castagnei* (Desm. & Mont.) Magnus, *Melampsora medusae* Thüm.

Very heavy infections of *L. tetraspora* and *M. populicola* were reported on balsam poplar stands throughout the Northwestern and North Central regions. Most stands in this area were affected, and many exhibited 100% infection levels and premature leaf drop. Damage by these diseases was less severe in the Northern Region, although *L. tetraspora* was found commonly in the Kapuskasing, Cochrane and Hearst districts, and *M. populicola* caused 100% defoliation of balsam poplar stands at two locations in the Chapleau District. Damage by the same two diseases was widespread in the Algonquin and Eastern regions but was generally less severe. Foliar damage in the 75-100% range was recorded at a few locations in the Pembroke, Bancroft, Tweed, Lindsay and Minden districts but was generally considerably lower elsewhere. This was particularly true in the Parry Sound, Minden and Huronia districts, where a pronounced reduction in infection levels was evident. Heavy infections of *M. castagnei* caused 20-100% foliar damage to silver poplar planted as an overstory for white pine in Wilberforce Township, Pembroke District,

and to scattered pockets of the same host in Sophiasburgh Township, Napanee District. Somewhat lighter defoliation (25%) was caused by *M. medusae* in a 4-ha stand of hybrid poplar planted as an overstory for white pine in Ross Township, Pembroke District.

Dutch Elm Disease, *Ceratocystis ulmi* (Buism.) C. Moreau

This disease was first observed in the Northwestern Region in 1977. In the intervening 10 years, it spread throughout the range of elm in the region, with reports of diseased trees in the towns of Rainy River and Kenora, and in Lake of the Woods Provincial Park. Quantitative sampling in the town of Rainy River showed that 50.5% of the trees were diseased and that the current mortality rate was 19.2%. Roadside trees along Highway 11 in McIrvine Township, Fort Frances District, have an infection level of 12.7% and a mortality rate of 4%.

Reports of the disease were also received from the Eastern Region, where quantitative sampling was carried out on surviving semi-mature elms and young elm reproduction. Infection levels in this part of the province ranged from 2% to 23%, and mortality was in the 1-2% range. Small patches of young roadside white elm in Pembroke District have an infection level of 25%. An evaluation of urban elms in the city of Thunder Bay disclosed an infection rate of 9% and 2% recent mortality.

Tip Blight, *Sphaeropsis sapinea* (Fr.) Dyko & B. Sutton

This disease continued to cause heavy damage to many older Scots pine plantations in the Maple and Cambridge districts; heavy damage was also apparent on young red pine growing in a frost pocket in Whitchurch Township, Maple District. Increased infection levels were observed in the Huronia District, with the most serious damage on 3-0 red pine seedlings growing adjacent to older infected red and Scots pine trees. In addition, numerous trees in a Scots pine Christmas tree plantation in Tiny Township suffered various degrees of branch mortality. Heavy infections were reported on two Scots pine plantations in South Walsingham Township, Simcoe District. One was a 20-ha private plantation of 15-m trees in which 80% of the trees sustained 60% branch mortality and 6% were dead. In the other, at the St. Williams Forest Tree Nursery, 99% of the 20-m trees were infected with 20% branch mortality and 5% whole-tree mortality. High infection levels were reported on ornamental Austrian pine in Presqu'ile Provincial Park; in the city of Kingston, Napanee District; in Gananoque, Brockville District; and in the city of Ottawa, Carleton Place District. A heavy infection was also reported in a Scots pine plantation in Lefroy Township, Blind River District.

Spruce Needle Rusts, *Chrysomyxa ledi* (Alb. & Schwein.) de Bary var. *ledi* and *Chrysomyxa ledicola* (Peck) Lagerh.

Although infection levels were still high in many areas of northern Ontario, foliar damage had, with a few exceptions, declined to generally low levels. The heaviest infection was reported in a 5-ha black spruce stand near Sidace Lake in Red Lake District, where 100% of the trees had overall foliar damage of 50%. Foliar damage ranged from 30% to 40% in a young black spruce stand on Highway 614 in Terrace Bay District, and 30% foliar damage was recorded in a white spruce plantation in Burwash Township, Sudbury District. The disease was reported from many other locations, often at infection levels of 100%; however, in most cases foliar damage was less than 5%.

Armillaria Root Rot, *Armillaria mellea* (Vahl: Fr.) Kummer

Surveys during the latter part of the field season again demonstrated that this disease is widespread in young pine plantations in Ontario. Reports of the disease were received from the Cambridge, Huronia, Owen Sound, Parry Sound, Chapleau, Gogama, Thunder Bay and Terrace Bay districts. It was observed in young white pine, red pine and jack pine stands and plantations, but in all instances infection levels were under 5%. Fruiting bodies of *A. mellea* were prolific in budworm-killed balsam fir stands in the Thunder Bay District.

Leaf Blight, *Septoria betulae* Pass.

For the second consecutive year, this late-season disease was prevalent in much of the Algonquin Region, and new infections were apparent in the southern portions of the North Bay, Sudbury, and Espanola districts of the Northeastern Region. The disease caused conspicuous yellowing and premature shedding of white birch foliage throughout these areas but the heaviest damage was recorded in the Massey-Richie Falls area of Espanola District, in the Powassan area of North Bay District and in the northern Parry Sound and southern Bracebridge districts.

Shoot Blight of Aspen, *Venturia macularis* (Fr.) E. Müller & v. Arx.

Heavy infections of this disease organism caused 80% leader damage on trembling aspen regeneration in Purdom Township, Nipigon District, and 90% leader damage in McEwing Township, Hearst District. The disease was also observed commonly in the Ignace, Red Lake and Sioux Lookout districts, where a single evaluation at Pike Lake, Ignace District showed 26% of the trees infected and 17% leader mortality. Low infection levels were reported from the Chapleau, Gogama, Pembroke and Bancroft districts.

Other Noteworthy Diseases

Surveys for eutypella canker of maple, *Eutypella parasitica* Davidson & Lorenz, in the Eastern Region showed infection levels ranging from 1.3% to 7.3%.

A survey for sirococcus shoot blight, *Sirococcus conigenus* (DC.) P. Cannon & Minter, in the Northwestern Region disclosed 36% infected red pine at Blue Lake Provincial Park, Dryden District, and 45% infected red pine with 3% recent mortality near Kathlyn Lake, Sioux Lookout District.

Tar spot needle cast, *Davisomycella ampla* (J. Davis) Darker, was found infecting 52% (17.3% severely) of young (1.2 m) jack pine trees in a 25-ha area in Lane Township, Blind River District. The same disease caused moderate foliar damage to jack pine at single locations in Nairn Township, Sudbury District, and Tennyson Township, Espanola District.

Reduced infection levels of horse chestnut leaf blotch, *Guignardia aesculi* (Peck) Stewart, were reported on ornamental trees throughout the Southwestern Region.

A medium infection of eastern gall rust, *Cronartium quercuum* (Berk.) Miyabe ex Shirai f.sp. *banksianae*, was recorded on red oak at Hiawatha Park in the city of Sault Ste. Marie, Sault Ste. Marie District, the first time the fungus has been recovered from its alternate host in this district.

A needle blight, *Lophophacidium dooksii* Corlett & R. Schoem., caused moderate foliar damage to white pine near Otter Lake, Poulin Township, and in Mississagi Provincial Park, Blind River District.

A leaf anthracnose, *Gnomonia caryae* Wolf var. *caryae*, was found at high infection levels in shagbark and bitternut hickory at single locations in Tweed, Napanee and Brockville districts. The same fungus was found on shagbark hickory at high infection but low foliar damage levels in numerous locations in the Niagara, Simcoe, Wingham and Aylmer districts.

A related anthracnose, *Gnomonia leptostyla* (Fr.) Ces. & de Not., was widespread at various infection levels on butternut in the Eastern Region and at one location in Dummer Township, Lindsay District.

A root rot, *Cylindrocladium floridanum* Sob. & C.P. Seym., caused mortality as high as 20% among red pine and black spruce seedlings in several compartments in the G. Howard Ferguson Forest Tree Nursery, Brockville District.

Infections of larch-poplar rust, *Melampsora medusae* Thüm., in hybrid poplar stool beds at the G. Howard Ferguson Forest Tree Nursery, Brockville District, were successfully controlled with the fungicide benlate.

Tomentosus root rot, *Inonotus tomentosus* (Fr.) Gilbertson, was found infecting white spruce in one compartment of the Bonner Tree Improvement Centre in Fauquier Township, Kapuskasing District.

A high incidence of fire blight, *Erwinia amylovora* (Burr.) Winslow et al., was reported on ornamental mountain-ash in the town of Iroquois Falls, Cochrane District, and on roadside mountain-ash north of the town of Chapleau, Chapleau District.

A leaf anthracnose, *Aureobasidium apocryptum* (Ell. & Ev.) Hermanides-Nijhof, caused foliar damage in the 90-100% range on red maple and white birch in the Cuttle Lake-Bears Pass area of Fort Frances District.

Heavy infections of another leaf anthracnose, *Apiognomonia errabunda* (Roberge) Höhnel, occurred on sugar maple near Sinclair Cove in Labelle Township, Wawa District, and near Rock Lake in Plummer Township, Sault Ste. Marie District. Somewhat lower levels of damage were recorded on sugar maple and red maple in Radcliffe and Richards townships, Pembroke District, on beech in Farraday Township, Bancroft District, and on red and bur oak in the Bracebridge, Minden and Parry Sound districts.

A leaf spot disease, *Tubakia dryina* (Sacc.) B. Sutton, caused 100% foliage browning of white oak at one location in Walford Township, Brockville District, and 60% foliar damage to red oak in the Apsley-Burleigh Falls area of Bancroft District.

A leaf anthracnose of birch, *Discula betulina* (Westend.) v. Arx, caused moderate-to-severe foliar damage to scattered pockets of white birch in the Algonquin Region.

Severe foliar infections of a leaf spot disease, *Phyllosticta* spp., were recorded on ornamental green ash at the Dryden Forest Tree Nursery in Zealand Township, Dryden District.

A 10% increase (to 25%) in infection levels of a needle cast disease, *Lophodermium* spp., was recorded in a 40-ha red pine plantation in Gurd Township, North Bay District.

ABIOTIC DAMAGE

Drought

Unusually warm weather in July and August, coupled with lower than normal rainfall, prompted reports of drought damage to forest trees at numerous locations in the Eastern, Algonquin and Northeastern regions. As usual, trees growing on shallow sites with thin soils suffered the most damage, usually browning, yellowing and curling of foliage followed by premature leaf fall. Some of the more severe damage was located as follows: in the southeastern corner of the Carleton Place District and adjacent northeastern corner of Brockville District and in the central Tweed District, where various hardwood species on exposed sites were affected; in the southern Bancroft District and in Raglan Township, Pembroke District, where various hardwoods, particularly sugar maple, were damaged; from the southeastern part of Minden District, northwest across the southern Bracebridge and Parry Sound districts, to Georgian Bay, with most hardwoods (particularly oak) affected; and in Nouvel Township, Blind River District, and north of Lake Superior between Montreal River and Wawa, where yellow and white birch were the most severely affected species. Stressed sugar maple and white birch also displayed drought symptoms on shallow-soil areas of the Bruce Peninsula in the Owen Sound District of the Central Region.

Blowdown

A severe storm with high winds on 22 August caused blowdown of forest trees in a number of areas in the Nipigon District. The main body of damage occurred between Parks Lake and the Namavaminikan River, where 1,349 ha, of mainly black spruce and trembling aspen, were flattened. An additional 162 ha were damaged on islands and on a peninsula on the north shore of Parks Lake. West of the Nipigon River, the same storm severely damaged some 250 ha of mainly black spruce and trembling aspen in the Elizabeth and Suzie Lakes areas. Single-tree blowdown and scattered breakage of trees were evident over a much wider area. An earlier storm on 23 July caused similar single-tree blowdown and breakage among urban trees in the Current River area of the city of Thunder Bay, Thunder Bay District.

Leaf Scorch

This condition, caused by high temperatures and low moisture conditions in spring and early summer, was widespread on sugar maple and beech in the Southwestern Region and in the Niagara District of the Central Region. Close examination revealed that damage usually consisted of a continuous band of necrotic tissue around the margin of the leaves. Typically, about 10% of the leaf surface was destroyed through about 75% of tree crowns. A similar situation was reported on individ-

ual trees and in small stands of white pine in northern Pembroke and eastern Algonquin Park districts. Foliar damage in these areas ranged as high as 60%.

Physiological Needle Drop

This drying condition caused foliar damage to most of the red pine trees in a small plantation in Parkinson Township, Blind River District. Thirty-eight percent of the trees suffered damage as a result of the same condition in a small mixed red and jack pine plantation in Sturgeon Township, Blind River District.

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31 December 1987

ISSN 0832-7173

REMARKS PRESENTED AT THE 1987 ONTARIO FOREST PEST REVIEWS

Sault Ste. Marie, 28 October

Toronto, 3 November

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Ten years ago, along with Bill Fullerton, then Director, Forest Management Branch, Division of Forests, Ontario Ministry of Natural Resources (OMNR), I signed a document stating that an annual review of the forest pest situation in Ontario would be presented by the Great Lakes [Forest Research] Centre (now the Great Lakes Forestry Centre [GLFC]), and would involve representatives of GLFC, OMNR and other agencies as appropriate.

The purpose of the review was to advise OMNR and the forest industry of the current status of major forest insect and disease problems in Ontario. The review was to be based on information and data, gathered by the Forest Insect and Disease Survey (FIDS) staff, on major problems, including the extent of the problem area, damage in the current year and a forecast of population levels and damage. Information on new or potential insect or disease problems was to be included as well. It was further stated that the information presented at the review would provide a basis for decisions on the need for major pest control programs in the following year and would be of use in the early planning and budgeting for such programs. Finally, there were to be two separate reviews, one for northern Ontario and the other for southern Ontario, and each was to require one full day.

The organization and presentation of these annual pest reviews is but one of the responsibilities of the FIDS Unit of GLFC. Indeed, a memorandum of understanding has just been signed by OMNR and GLFC, spelling out the respective roles of the two agencies. Specifically, GLFC has the following additional responsibilities:

1. to conduct an annual review survey to detect the occurrence of and evaluate the damage caused by forest pests

2. to assign 14 FIDS rangers in the field for at least 20 weeks annually to conduct the overview survey

3. to maintain a specimen collection and provide diagnostic service

4. to assess the effectiveness of OMNR's annual insecticide spraying program

5. to conduct special surveys as required and as mutually agreed upon by OMNR and the Canadian Forestry Service (CFS)

6. to conduct trials to expand registration of existing forest pesticides to include other insects, diseases or host trees in Ontario conditions

7. to conduct research to develop and improve procedures and sampling methods used in insect and disease surveys and assessments

8. to participate in regional and other planning committees as requested for the purpose of planning pest management operations

9. to conduct studies to obtain estimates of volume losses due to reduced growth and mortality.

Meanwhile, OMNR provides 400 hours of flying time for detection surveys and damage mapping, partial funding to operate field crews and foliage mills for assessment of the OMNR annual insecticide spray program, and advice on sampling locations on the basis of forest values.

In accordance with the agreement, two forest pest reviews have been held annually since 1977. During this 10-year period there has been a dramatic increase in the number of participants. In 1977, the first year, 39 people attended the two reviews--18 in Toronto and 21 in Thunder Bay. The numbers doubled to 78 in 1979, and rose steadily until 1985, when there were 232 participants, 112 in Toronto and 120 in Sault Ste. Marie. Last year, the 10th, total numbers declined slightly, but the Toronto review attracted a record 136 participants. Initially, the reviews were restricted by invitation, but now they are open to all interested individuals.

Recent pest reviews have attracted a far broader participation than originally anticipated. In addition to OMNR, GLFC and the Ontario forest industry, representatives of the following agencies or organizations have attended the review.

Manitoba Department of Natural Resources
Michigan Department of Natural Resources
Minnesota Department of Natural Resources
Agriculture Canada, Plant Health Division
Ontario Centre for Remote Sensing
Ontario Ministry of the Environment
Ontario Ministry of Agriculture and Food
Other agencies including FPMI, PNFI, CFS headquarters, the Northern Forestry Centre, CFS Maritimes and the Laurentian Forestry Centre
the pesticides industry
the mining industry
universities and colleges

Pollution Probe
Temiskaming Environmental Action Committee
Ontario Pesticides Advisory Committee
National Capital Commission
Ontario Forestry Association
Ontario Forest Industries Association
Federation of Ontario Naturalists
aerial spray companies
tree care companies
forestry and pest control consultants
Conservation Authorities
municipalities
counties
botanical gardens and arboreta.

Similarly, the technical content of the reviews has broadened. Not only do presentations deal with the status and trends of major or anticipated pest problems, but they also treat topics such as reports of operational spraying programs, research on pest dynamics and new control techniques, new survey tools such as pheromones, damage assessment by remote sensing, herbicides, and updates on the status of pesticides. Films have also been shown during the past few years.

With this broadening of content, the reviews have evolved into a major forum for information exchange on forest pests in Ontario. They are no longer aimed primarily at providing specific information for decision-making on pest control programs or at assisting in planning and budgeting. Obviously, these programs now require a much longer planning period and more detailed regional and district information than they did a decade ago.

In 1977 when the first pest reviews were held, the major pest problem was the spruce budworm and the infestation covered some 14 million ha, primarily in the Northern and Northeastern regions of the province. During the intervening years we saw the size of the infestation increase to a peak of 18.85 million ha in 1980; in 1987 the infestation still covers some 7.2 million ha. Meanwhile, we have seen a major increase in, and subsequent collapse of, the jack pine budworm infestation. The area infested rose to 3.66 million ha in 1985 before declining to 0.5 million ha in 1987, and a further major reduction is anticipated in 1988. A third major outbreak involved the gypsy moth, which infested almost 250,000 ha in 1985. By 1987 the size of the infestation had decreased to 12,700 ha.

Other pests discussed and reviewed include the forest tent caterpillar, Scleroderris canker, pinewood nematode, Fomes root rot, gall rust, Bruce spanworm, Swaine jack pine sawfly, brown spot needle blight, Diplodia tip blight, oak leaf shredder, maple decline, hardwood dieback, black army cutworm, Dutch elm disease, sawyer beetles, and hemlock looper.

In addition, the Acid Rain National Early Warning System (ARNEWS) has been discussed as have plantation, seed and cone, and nursery pests of major host species.

It is apparent that forest insects and diseases have a significant impact on Ontario's wood supply; essentially they are in competition with man for a finite resource. Although provincial authorities indicate that there is no overall wood supply problem in Ontario, they do acknowledge that there are local shortages and that the wood supply must be carefully managed.

Information from the Ontario Forest Industries Association indicates that the total harvest by man is approximately 20 million m^3 per year. At the same time, losses due to the spruce budworm are estimated at 13 million m^3 per year, and fire consumes another 6 million m^3. In other words, the total losses to fire and spruce budworm approach the amount harvested by the forest industry. The need to reduce these losses seems apparent.

Without doubt the most significant issue in pest control programs is that of the use of chemical insecticides. Their use has been reduced dramatically over the past decade and it seems unlikely that they will ever again be the principal means of pest control. However, it must be recognized that the current alternatives to chemicals are very few; although *Bacillus thuringiensis (B.t.)* can be used as effectively as chemicals, it must be applied more carefully and it has a much narrower timing window than chemicals. In addition, *B.t.* is not effective on all pests (e.g., sawflies). Forest pest managers will require a balance of biological and chemical controls as well as silvicultural methods for effective, integrated forest pest management. It should also be noted that the operational use of pesticides for forestry purposes is highly regulated in Canada. There are stringent federal registration processes as well as comprehensive provincial regulations, training requirements, and licensing and permit systems; very few products, in fact, are registered for forestry use. Still another approach is the use of parasites and predators in forest pest management.

For many years pest surveys and forest protection were traditionally considered separate forestry operations, seemingly unrelated to forest management. However, as the wood supply has tightened and forest regeneration programs have expanded, pest surveys and forest protection have become recognized as an integral part of forest management. Indeed, without protection, there is little rationale for silviculture. There is not much use in undertaking programs to increase wood supply if the resultant increase is not available for harvesting.

It seems to me that forest pest programs must follow some of the trends in forest fire management. There is a need to move from a control strategy to a prevention strategy. We must learn to predict outbreaks and to control them at an early stage; we need new detection methods and enhanced information on insect behavior. We also need better information on the impact of pests to assist us in setting priorities in survey activities, research and control operations. Research programs will have to be carried out not only during outbreaks but also during periods when populations are small. This will be a challenge to our entomologists, who will also be expected to respond to the serious problems and issues of the day. Long-term commitment to entomological programs will be required. Research will be needed to improve control procedures, both chemical and biological. We will have to increase our arsenal of pesticides, to develop improved methodologies for their application and to compare alternative control techniques. We will have to learn more about insect pests and diseases of the new forest; all indications point to the fact that we can anticipate new and increasing problems in our second-growth forests. Also, forest entomologists and pathologists can no longer work by themselves; the interaction between pests and hosts requires that multidisciplinary research groups be established.

These are challenging times for forest pest managers and researchers. Managers have a responsibility to employ the most effective strategies to manage forest pest populations; researchers have a responsiblity to ensure an increased understanding of forest pests and their relation with the forest.

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